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THE PEORIAN SOIL AND WEATHERED ZONE (TORONTO FORMATION ?)¹

THE interval between the Iowan and Wisconsin stage of glaciation has been provisionally named Toronto by Professor Chamberlin, because of excellent exposures of interglacial fossiliferous beds along the Don Valley in Toronto, Ontario, which may prove to have this age.² Professor Chamberlin remarks in connection with the introduction of this name that the grounds for this correlation are not very strong, and further investigation may show them to be erroneous, but that it is not likely that the beds upon the Don can be referred to any earlier period. He further remarks, that, "Whether the beds on the Don belong to the horizon suggested or not, it is certain that vegetal beds were formed in the interval of the retreat between the formation of the Iowan till and the formation of the Wisconsin till, and some of these less well developed and less known deposits must be looked to as a type of this interglacial horizon if the Toronto beds prove unavailable."

In view of the uncertainty attached to this correlation, it seems advisable to employ for the present a substitutional name which is known to be applicable to the interval between the Iowan and the early Wisconsin. In case the correlation suggested by Professor Chamberlin is demonstrated to be correct the name Toronto has precedence.

Extensive deposits of muck and peat occur at the base of the Wisconsin drift in northern Illinois, notably in McHenry, Kane, De Kalb, La Salle, and Bureau counties, which are in all probability immediately underlain, in some cases at least, by

¹ This paper forms part of an unpublished report by the writer on the Illinois glacial lobe. It is published in connection with the two papers read before the Iowa Academy because of the close relation of the subject-matter.

² Classification of American Glacial Deposits, by T. C. CHAMBERLIN, *JOUR. GEOL.*, Vol. III, 1895, pp. 270-277.

Iowan drift. In central and western Illinois the soil is in places underlain by a fossiliferous silt, referred with some confidence to the Iowan loess. In eastern Illinois the Iowan till may be present. This soil horizon, together with lower soil horizons, was discussed by the writer in a paper presented at the Cleveland meeting of the American Association for the Advancement of Science.¹ At that time the separation of the Iowan sheet from the Illinoian had not been made and all the soils were referred to a single horizon. The later developments have led the writer to separate the soils found at, or slightly below, the Wisconsin drift into two classes—one class being thrown into the Sangamon stage, while the other is thrown into the stage under discussion. It is not possible in all cases to decide to which class a buried soil should be referred, for in some cases its existence is known only through well records. The separations thus made are set forth in detail in a report by the writer yet unpublished.

In selecting a name for the horizon, the ideal locality would be one in which the earliest sheet of Wisconsin till overlies the Iowan till. In the vicinity of Marengo, in McHenry county, a black muck has been found at the base of the Wisconsin drift, and it apparently rests on Iowan till. This might be taken as a type locality were it not that the Wisconsin drift at that point may not include the Shelbyville or earliest Wisconsin sheet of till. The same objection may be urged against buried soils found in Kane, De Kalb, La Salle, and Bureau counties, for in all these counties the outer Wisconsin ridge appears to be the Bloomington moraine, and the limits of the Shelbyville may be to the east of this ridge. It has seemed advisable, therefore, in the selection of a type locality to pass to central Illinois, where the Shelbyville sheet extends beyond the later sheets of Wisconsin drift. This, unfortunately, carries us beyond the Iowan till, but the loess, whose deposition seems to mark the close of the Iowan glaciation is there well developed. The interval between the loess and Shelbyville till sheet probably marks as

¹For abstract of paper see Proc. A. A. A. S., 57th meeting, 1888, pp. 183-184.

well the time between the culmination of the Iowan and Wisconsin glaciations as if taken where the Shelbyville sheet overlies Iowan till.

The loess has been traced back in valley exposures several miles beneath the Shelbyville till sheet in northern Tazewell county, Illinois, and beneath the combined Shelbyville and Bloomington sheets in Woodford and Bureau counties. Farther south it has been recognized in well sections in southern Tazewell, northeastern Logan, western De Witt, southern Macon, and western Sullivan counties, Illinois. The phase of loess known as white clay has been traced several miles up the Kaskaskia and Embarras valleys in Shelby and Coles counties beneath the Shelbyville till sheet.

Of the several exposures those east of Peoria in northern Tazewell county are the best displayed. Decisive evidence is also found at these exposures of an interval of some length between the deposition of the loess and the deposition of the overlying Shelbyville till sheet. In view of these conditions in the vicinity of the city of Peoria it has seemed appropriate to apply the name Peorian to the interval between the Iowan loess and the Shelbyville till sheet, a till sheet which appears to be the earliest of the Wisconsin series.

In exposures along the T. P. & W. R. R., east of Peoria, and also on the east bluff of the Illinois opposite that city, the Shelbyville sheet is underlain by a bed of fossiliferous loess, similar to that found on the surface of the Illinoian outside the limits of the Shelbyville drift sheet, both in texture and in age. The loess is 8 to 12 feet in thickness, or about the same as on the uplands outside the Shelbyville sheet. It occurs at a corresponding elevation of about 200 feet above the Illinois River. Beneath it there is exposed fully 100 feet of the older drift sheet.

The upper part of the loess to a depth of two or three feet presents a reddish brown color, and is thoroughly leached. The leaching extends usually to a depth of about six feet. But beneath that depth the loess is often calcareous. The Shelby-

ville till was found to be very calcareous immediately above the loess. The evidence of a weathered zone at the top of the loess is as clearly shown as at the top of the underlying Illinoian till and several exposures occur in which the two weathered zones may seem in vertical sections. It is probable, however, that such a zone would be developed more rapidly in the loess than in the till, because of the greater porosity of the former.

Evidence of an interval between the Iowan and early Wisconsin glaciations is found in the great dissimilarity in the outline of the two ice sheets. The outline is more out of harmony, both with the early Wisconsin and the Illinois, than the outline of those sheets with each other. The great extension toward the south border of the driftless area, both in the Iowa and Illinois lobes of Iowan ice is singularly out of harmony with both succeeding and preceding glaciations. The shifting of lobes involved in the change from the Iowan to the early Wisconsin can scarcely be assumed to have occurred in a brief interval. The moraine-forming habit of the Wisconsin and absence of distinct morainic belts in the Iowan also implies a change in glacial conditions that can scarcely be assumed to have taken place suddenly.

Evidence of an interval between the deposition of the Iowan loess and associated silts, and that of the Shelbyville till, is found in a change in the attitude of the land which resulted in a marked deepening of the valleys. There appears to have been a greater depth of excavation during the Peorian interglacial stage than during the Sangamon. The breadth of excavation, however, was reduced to but a fraction of that in the Sangamon stage. The amount of change in altitude can as yet scarcely be even conjectured, much less demonstrated, but its effects on the drainage are such as to support the view that it denotes a time interval of considerable length; a view which is also supported by the work accomplished in deepening the valleys. Comparing the work with substages of the Wisconsin it appears that the interval may not greatly exceed that between the Shelby-

ville and Bloomington ice advances. The Shelbyville sheet had apparently become channeled by streams prior to the Bloomington substage of glaciation to nearly as marked a degree as the channeling below the level of the loess effected in the Peorian stage of deglaciation. There is also a marked increase in the stream gradient, the Bloomington drift sheet being accompanied by a much more vigorous gravel outwash than that which accompanies the Shelbyville sheet. In the writer's opinion it is questionable if the interval between the Iowan and early Wisconsin invasions covers more than a comparatively small part of the time occupied by the intervals between the Iowan and Illinoian, and between the Illinoian and Kansan. The union of the several lines of evidence just cited would seem to support the view that it is longer than interglacial substages of the Wisconsin. The view of a brief interval between the Iowan and Wisconsin meets a strong objection, however, in the supposed attendant deposits at Toronto.

Turning to the Toronto formation it is found that a fossiliferous silt occupying a horizon between bowldery glacial clays has a fauna and flora which denote a climate fully as mild as at present characterizes that region.¹ In discussing this formation Dr. A. P. Coleman remarks that unless the Labrador gathering ground is shown to have stood much higher than at present it can scarcely be supposed that a widespread sheet of ice was maintained there, while oaks and maples and pawpaws flourished on the land and Mississippi unios in the waters within 400 to 500 miles to the southwest. In the absence of any evidence of such an uplift he concludes that the ice fields were completely melted during this interglacial epoch. Professor D. P. Penhallow remarks that the arborescent forms of vegetation in these interglacial beds are of species such as may now be found in the same region.

¹See descriptions by DR. A. P. COLEMAN and PROFESSOR D. P. PENHALLOW in *American Geologist*, Vol. XIII, Feb. 1894, pp. 85-95. See also additional interpretation by DR. COLEMAN, in *JOUR. GEOL.*, Vol. III, pp. 274, 622-645.

For description of fossiliferous beds at Scarborough Heights and other localities near Toronto, by DR. G. J. HINDE, see *Journal of the Canadian Institute*, April 1877.

The extent of deglaciation suggested by these beds, so far as space is concerned, can scarcely be supposed to have been exceeded either by the Sangamon or the Yarmouth stage of deglaciation. The Toronto beds constitute probably the most decisive evidence yet brought forward in support of an extensive deglaciation within the glacial period. The time involved may reasonably be supposed to involve a portion of the glacial period by no means small. Its rank should be as high as that of any of the interglacial stages, even if less prolonged than some of the earlier stages of deglaciation. Should it be proved to represent the interval between the Iowan and Wisconsin deposits, as now seems probable, the evidences above cited, from the peripheral portion, may aid in determining its length, namely, the leaching and erosion of the Peorian stage. As yet the fauna and flora buried beneath the peripheral portion of the Wisconsin drift have received little or no attention. Possibly by the aid of this line of study the question of correlation may be settled.

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